WE CLAIM:

1. An ozone removal system for an aircraft, comprising:

a housing having an upstream end and a downstream end;

a substrate disposed within said housing, said substrate and said housing adapted for the passage of an air stream therethrough;

a titania catalyst support disposed on a surface of said substrate;

a first duct affixed to said upstream end of said housing, said first duct coupled to an air intake unit for providing said air stream; and

a catalytic composition disposed on said titania catalyst support, wherein said catalytic composition comprises:

at least one silver-based component selected from the group consisting of Ag (silver) metal and AgO (silver oxide), and

at least one palladium-based component selected from the group consisting of PdO (palladium oxide), PdO_2 (palladium dioxide), and Pd (palladium) metal, wherein said catalytic composition is adapted for the catalytic removal of ozone from said air stream at temperatures within the range of from about 100 to 500° F.

2. The ozone removal system of claim 1, wherein said air stream has a flow rate of from about 1 to 500 pounds of air per minute.

3. The ozone removal system of claim 1, wherein said catalytic composition is provided in an amount sufficient to decrease a first ozone concentration in said air stream of about 2.0 ppm to a second ozone concentration of 0.1 ppm or less.

4. The ozone removal system of claim 1, wherein said air intake unit comprises a dedicated ambient air compressor of said aircraft.

5. The ozone removal system of claim 1, wherein said catalytic composition consists essentially of Ag (silver) metal and PdO (palladium oxide).

6. An ozone removal system, comprising:

a housing having an upstream end and a downstream end;

a substrate disposed within said housing;

a layer of titania disposed on a surface of said substrate; and

a catalytic composition disposed on said layer of titania, said catalytic composition comprising:

a first catalytic component capable of efficient decomposition of ozone within a first temperature range, and

a second catalytic component capable of efficient decomposition of ozone within a second temperature range,

wherein said first catalytic component consists essentially of Ag (silver) metal, and said first temperature range is from about 100 to 300° F.

7. The ozone removal system of claim 6, wherein said second catalytic component consists essentially of PdO (palladium oxide), and said second temperature range is from about 300 to 500° F.

8. The ozone removal system of claim 7, wherein said second catalytic component is reversibly deactivated at temperatures below said second temperature range.

9. The ozone removal system of claim 6, wherein said ozone removal system is adapted for use on a commercial passenger aircraft, and wherein said ozone removal system is adapted for maintenance-free operation on said commercial passenger aircraft for a period of at least 20,000 hours at an operating temperature within the range of from about 100 to 500° F.

10. A catalytic system for removing ozone from an air stream, comprising:

an air intake unit for providing said air stream;

a catalytic unit disposed downstream from said air intake unit;

a first duct affixed to an upstream end of said catalytic unit, said first duct adapted for channeling said air stream to said upstream end of said catalytic unit; and

a second duct affixed to a downstream end of said catalytic unit, wherein said catalytic unit comprises:

a housing;

a substrate disposed within said housing;

a layer of titania disposed on a surface of said substrate; and

a catalytic composition disposed on said layer of titania, said catalytic composition comprising a first catalytic component adapted for efficient removal of ozone from an air stream within a first temperature range, and a second catalytic component adapted for efficient removal of ozone from an air stream within a second temperature range, wherein said first catalytic component comprises silver, said second catalytic component comprises palladium oxide (PdO), and wherein said second catalytic component is reversibly deactivated at temperatures below said second temperature range, wherein said second temperature range is from about 300 to 500° F.

11. The catalytic system of claim 10, wherein:

said second duct is coupled to an environmental control system of an aircraft, and

said second duct is adapted for channeling said air stream to said environmental control system.

12. The catalytic system of claim 10, wherein:

said layer of titania is present in an amount of from about 1500 to 5000 g/ft^3 of said substrate.

13. The catalytic system of claim 10, wherein:

said catalytic composition is present in an amount sufficient to decrease an ozone concentration in said air stream by at least twenty fold (20X).

14. The catalytic system of claim 10, wherein:

said silver is in an amount of from 50 to 500 g/ft^3 of said substrate, and

said PdO is in an amount of from 25 to 300 g/ft^3 of said substrate, and wherein:

said catalytic unit is adapted for providing cleansed air having an ozone concentration of 0.1 ppm or less.

15. The catalytic system of claim 10, wherein:

said air stream is provided by bleed air from a gas turbine engine, and

said air stream has a temperature of at least about 100° F.

16. The catalytic system of claim 10, wherein:

said air stream is provided by a dedicated ambient air compressor of an aircraft, and

said air stream has a temperature below 500° F.

17. An aircraft having an interior air space, comprising:

an ozone removal system including a catalytic unit, said catalytic unit in communication with said interior air space, and said catalytic unit adapted for passage of an air stream therethrough at a flow rate of from about 1 to 500 pounds of air per minute, wherein said catalytic unit comprises a first catalytic component adapted for efficient catalytic removal of ozone from said air stream over a first temperature range, and said catalytic unit further comprises a second catalytic component adapted for efficient catalytic removal of ozone from said air stream over a second temperature range, wherein said first temperature range is from about 100 to 300° F, and wherein said second temperature range is from about 300 to 500° F, and wherein said catalytic unit further comprises:

a substrate;

a titania catalyst support disposed on said substrate; and

a catalytic composition disposed on said titania catalyst support, said catalytic composition comprising said first catalytic component and said second catalytic component, said first catalytic component consisting essentially of silver, and said second catalytic component consisting essentially of PdO (palladium oxide).

18. The aircraft of claim 17, wherein said ozone removal system further comprises an air intake unit for providing said air stream to said catalytic unit, and wherein said air intake unit comprises a dedicated ambient air compressor.

19. The aircraft of claim 17, wherein said interior air space includes an aircraft cabin, and said catalytic unit is capable of catalytically removing ozone from said air stream to provide cleansed air, having an ozone level of 0.1 ppm or less, to said aircraft cabin.

20. A method for the catalytic removal of ozone from an air stream, comprising:

a) providing a catalytic unit adapted for the passage of said air stream therethrough, said catalytic unit comprising:

a substrate disposed within a housing;

a layer of titania disposed on a surface of said substrate; and

a catalytic composition disposed on said layer of titania, said catalytic composition comprising a first catalytic component capable of efficient decomposition of ozone within a first temperature range, and a second catalytic component capable of efficient decomposition of ozone within a second temperature range, wherein said second catalytic component is reversibly deactivated at temperatures below said second temperature range;

b) providing said air stream comprising said ozone;

c) passing said air stream, at a flow rate of from about 1 to 500 pounds of air per minute, through said catalytic unit; and

d) catalytically decomposing said ozone by contacting said air stream with said catalytic composition.

21. The method of claim 20, wherein said step b) comprises: compressing ambient air via a dedicated ambient air compressor or via a compressor integral with a gas turbine engine.

22. The method of claim 20, wherein said step b) comprises:
prior to said step c), heating ambient air to a temperature in the range of from about 100 to 500° F.

23. The method of claim 20, wherein said step d) comprises decreasing a level of said ozone in said air stream, from a first concentration in the range of from about 0.2 to 2 ppm to a second concentration of about 0.1 ppm or less, during a maintenance-free period of operation of said catalytic unit

of at least 20,000 hours.

24. The method of claim 20, wherein said first catalytic component comprises at least one silver-based component selected from the group consisting of Ag (silver) metal and AgO (silver oxide), and said second catalytic component comprises at least one palladium-based component selected from the group consisting of PdO (palladium oxide), PdO_2 (palladium dioxide), and palladium metal.

25. The method of claim 20, wherein said catalytic unit is disposed downstream from an air intake unit of an aircraft and upstream from an environmental control system of said aircraft.

26. A method for the catalytic removal of ozone from an air stream, comprising:

a) compressing ambient air to provide said air stream at a temperature of from about 100 to 500° F;

b) passing said air stream over a catalytic composition at a flow rate of from about 1 to 500 pounds of air per minute; and

c) catalytically decomposing said ozone in said air stream to provide cleansed air having an ozone concentration of 0.1 ppm or less, wherein said catalytic composition comprises silver metal and palladium oxide (PdO), and wherein said catalytic composition is disposed on titania.

27. The method of claim 26, wherein:

said step a) comprises compressing said ambient air using a dedicated ambient air compressor.

28. The method of claim 27, wherein:

said step b) comprises passing said air stream over said catalytic composition at a temperature in the range of from about 100 to 500° F.

29. The method of claim 26, wherein:

said air stream comprises bleed air from a gas turbine engine, and

said air stream has a temperature of from about 300 to 500° F.

30. A method for making an ozone removal catalytic system for removing ozone from an air stream, the method comprising:

a) providing an ozone removal catalytic unit, wherein said step a) comprises:

i) providing a substrate;

ii) applying a titania catalyst support layer to said substrate to provide a coated substrate;

iii) depositing an ozone removal catalytic composition on said titania catalyst support layer to provide a catalytic coated substrate, wherein said catalytic composition comprises a first catalytic component comprising silver and a second catalytic component comprising palladium oxide (PdO), wherein:

said first catalytic component is in an amount of from about 50 to 500 g/ ft^3 of said substrate, and

said second catalytic component is in an amount of from about 25 to 300 g/ ft^3 of said substrate;

iv) providing a housing adapted for accommodating said catalytic coated substrate; and

v) arranging said catalytic coated substrate within said housing.

31. The method of claim 30, further comprising:

b) coupling an upstream portion of said housing to an air intake unit of an aircraft.

32. The method of claim 31, further comprising:

c) coupling a downstream portion of said housing to an environmental control system of said aircraft.

33. The method of claim 30, wherein said step ii) comprises applying said titania catalyst support layer in an amount of from about 1500 to 5000 g/ft^3 of said substrate.

34. The method of claim 30, wherein said step iii) comprises:

vi) applying an aqueous solution to said titania catalyst support layer; and

vii) heating said applied aqueous solution to transform said aqueous solution to said catalytic composition, wherein said aqueous solution comprises at least one of a silver precursor compound, and a palladium precursor compound.

35. The method of claim 34, wherein said step vii) comprises:

viii) after allowing said applied aqueous solution to dry under ambient conditions on said titania catalyst support layer, increasing the temperature from ambient to a maximum temperature in the range of from about 200 to 600° C over a period of from about 30 minutes to 3 hours.

36. The method of claim 35, wherein:

said maximum temperature is in the range of from about 400 to 550° C.

37. The method of claim 30, wherein:

said first catalytic component and said second catalytic component are evenly distributed within said titania catalyst support layer.

38. The method of claim 34, wherein:

said silver precursor compound is selected from the group consisting of an organometallic silver compound and a silver salt, and

said palladium precursor compound is selected from the group consisting of an organometallic palladium compound and a palladium salt.